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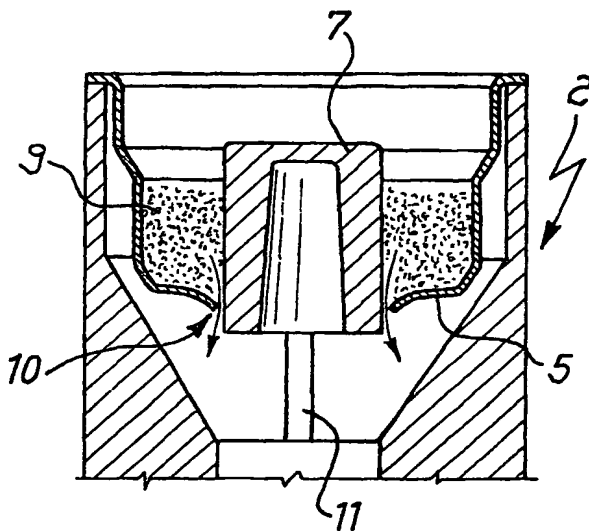
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(54) Title: **DISPENSING ASSEMBLY FOR PREPARING BEVERAGES FROM SOLUBLE PRODUCTS**



(57) Abstract: A method and a group are described for the preparation of a beverage from soluble products contained in a disposable cartridge (1), based on the regulation of the dispensing of the beverage in such way that the soluble product is delivered in suspension for at least 75% of the total dispensing time. According to one embodiment said group comprises one delivery port between the wall of the piercing member (7) and the edge (5a) of the outlet opening of the cartridge (1).

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**Title: "DISPENSING ASSEMBLY FOR PREPARING BEVERAGES FROM SOLUBLE PRODUCTS"**

TECHNICAL FIELD OF THE INVENTION

The present invention relates to the preparation of beverages from soluble products contained in disposable cartridges, for example the preparation of beverages carried out in machines provided with a collecting device made to receive a cartridge of soluble product in order to produce hot beverages such as coffee, cappuccino, tea or the like.

BACKGROUND ART

In the known machines, groups designed for the preparation and dispensing of beverages generally comprise a collecting device having a seat that receives a disposable cartridge.

Since the disposable cartridges are originally sealed to avoid spillage of the soluble product during handling, the collecting device is generally fitted with a piercing member that opens one or more outlet openings on one wall of the cartridge (for example, on the base wall of the same) in correspondence to a plurality of pre-established breaking lines.

Once the cartridge is inserted into the appropriate seat on the collecting device, water is admitted under pressure to the inside of the cartridge through an entry port of the same in order to form a beverage consisting of a suspension or dispersion in water of the soluble product, which is dispensed through an outlet opening or hole located on the cartridge. A dispensing group must guarantee complete and uniform solubilization or suspension/dispersion of the product in the fluid (usually water) inside the cartridge and good final appearance of the beverage; in the case of coffee and cappuccino good final appearance means being "creamy", i.e. having an appreciable amount of a layer of enduring small-bubble froth. Obtaining such a result is complicated by the fact

that the shape and dimensions of the cartridge are the same for all products dispensed, while the amount of soluble product in the cartridge varies dramatically from product to product (for example: 1.5 grams for espresso coffee and 15-16 grams of product for chocolate and cappuccino). This variation in amount affects the capacity to solubilize the product homogeneously. Another problem of the known dispensing groups is guaranteeing thorough cleaning of the group; this requires avoiding the use of dispensing conduits and tubes with section less than 2 mm, because of the risk of formation of coatings and residues in the same.

In a previous patent application, still pending, in the name of the same Applicant, it is suggested to provide a throttling arrangement along the dispensing course of the beverage with the aim of improving the mixing of the soluble product with the water admitted to the cartridge and to creating a pressure gradient inside the cartridge so as to obtain a good quality beverage with attractive appearance on delivery. This has been achieved by means of a piercing member having a diameter greater than the diameter of the product outlet opening: the pressure of the water on arrival in the cartridge determines solubilization and delivery of the beverage.

However, it has been found that the beverage obtained is not always optimum, in particular with respect to the amount and duration of cream produced.

#### SUMMARY OF THE INVENTION

The object of the present invention is therefore to produce a dispensing group for the preparation of beverages able to guarantee optimum delivery from point of view of the beverage quality, independently of the characteristics of the cartridge containing the soluble product.

This object is achieved by the present invention by means of a group for

the preparation of beverages according to Claim 1. Particular embodiments of the dispensing group according to the invention are set out in the dependent Claims 2 to 15.

According to a first aspect of the present invention, the beverage preparation group comprises means of regulating the dispensing of the beverage in such way that the soluble product is delivered in suspension for at least 75% of the total dispensing time.

According to another aspect of the present invention, the means of regulation comprise an outlet opening in a cartridge and a piercing member of such dimensions that the piercing member initially engages said outlet opening completely, i.e. before the dispensing of the beverage, and that one or more outlet ports are present between said cartridge and said piercing member during and/or after the dispensing of the beverage.

In a preferred embodiment, the dispensing port has a substantially circular crown section, and the ratio  $R$  between the diameter  $D2$  of the section of engagement of the piercing member and the diameter  $D1$  of the outlet opening is  $1 \leq R \leq 1.067$ , preferably  $1 \leq R \leq 1.04$  and still more preferably  $1 \leq R \leq 1.02$ . For example, if the diameter of the piercing member is 15 mm, the diameter  $D1$  of the outlet opening in the cartridge is  $15 \leq D1 \leq 16$  mm, more preferably  $15 \leq D1 \leq 15.6$  mm, still more preferably  $15 \leq D1 \leq 15.3$  mm.

In another possible embodiment, usable as alternative to or in combination with the previous one, the dispensing group of the invention comprises an outlet opening in a cartridge and a piercing member of such dimensions that the piercing member initially engages said outlet completely, i.e. before the dispensing of the beverage, and one or more ports are present between said cartridge and said piercing member during and/or after the dispensing of the beverage, as well as means of

limiting the deformation of the base wall of the cartridge to a maximum angle of approximately 45 degrees. In an embodiment such means of limiting the deformation comprise one or more stop elements located on said collecting device in proximity of the outlet opening of the mounted  
5 cartridge.

Such stop elements could comprise for example: one or more supports of the piercing member, or a annular member having diameter greater than the outlet opening.

In the latter case, the annular member has a tilted surface portion turned  
10 towards the piercing member and towards the base wall of the cartridge, with inclination between 0° and 45° with respect to a horizontal plane supported on the annular member, more preferably with inclination between 15° and 38° or still more preferably equal to 30° with respect to a horizontal plane supported on the annular member.

15 In accordance with a second aspect of the present invention, a method for preparation of beverages as specified in Claim 16 is provided for. Further advantageous characteristics of the method according to the invention are set out in the dependent Claims 17 to 30.

The dispensing group according to the invention has numerous  
20 advantages. The reduced diameter dispensing ports that are formed between cartridge and piercing member during the beverage dispensing phase constitute a temporary throttling, i.e. a throttling that is eliminated at each delivery when the cartridge is removed, and that is newly created at the following delivery when a new cartridge is inserted  
25 into the collecting-piercing device. Further advantages are the homogenous and uniform solubilization of the product and the production of a beverage with optimum appearance.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Further characteristics and advantages of the present invention will

become clearer from the following description, which is given by way of example and is not limiting, with reference to the attached schematic drawings, in which:

- Figure 1 is a perspective view of a cartridge which can be used  
5 on a dispensing group according to the present invention;
- Figure 2 is a section view of the cartridge of fig. 1;
- Figure 3 is a perspective view of a collecting-piercing device;
- Figure 4 is a section view of the collecting-piercing device of fig. 3  
with a cartridge inserted and perforated, during dispensing;
- 10 - Figure 5 is a section view of a further type of collecting-piercing  
device provided with a deformation control ring;
- Figure 6 is a view in plan of the collecting-piercing device of fig.  
5;
- Figure 7 is a schematic bottom view and in partial section of the  
15 piercing member and the cartridge base wall with outlet opening;
- Figure 8 is a magnified section view of the zone of engagement  
between piercing member and cartridge base wall during dispensing of  
the beverage;
- Figure 9 is a section view of an embodiment of the collecting  
20 device.

#### MODES FOR CARRYING OUT THE INVENTION

With reference to figures 1-3, the dispensing group according to the invention comprises a disposable cartridge 1 and collecting-piercing device 2. The cartridge 1 is equipped with an upper surface having an opening 4 encircled by a flange 3, and by a lower base wall 5 on which  
25 a breaking line 5a is obtained so that it defines an outlet opening for the solubilized product. The upper opening 4 is closed in a known way by a cover (not shown) provided with one or more inlet holes for the water of infusion, solubilization or dispersion-suspension. In a known way, the

breaking line 5a consists of a linear curved portion of the base wall having reduced thickness and such that it can be easily broken by the piercing cylinder 7 of the collecting device 2; the line 5a is interrupted in correspondence to a portion 6 that constitutes a hinge for portion 8 of base wall (referred to as "cover") defined by the line 5a and preventing the separation of the same from the rest of base wall 5 after the cartridge has been engaged on the collecting-piercing device 2 (fig. 4). In figure 4 a cartridge 1 is shown in dispensing position, i.e. in the position in which it has been engaged by cylinder 7, which has caused the opening of base wall 5 along the line 5a and the movement of base wall portion 8 towards the inside of the cartridge. The soluble product to be delivered is outlined and indicated by reference number 9.

According to the present invention the cartridge is made of a deformable material and the dimensions of the section of engagement with piercing cylinder 7 are equal to or greater than the dimensions of portion 8 of base wall 5 and are such that when the cartridge is inserted onto cylinder 7, during feeding of hot water under pressure, there is at least one port or space 10 between the base wall 5 and piercing member 7 to allow the exit of the solubilized product.

The port 10 is preferably provided in the shape of a circular crown (fig. 7), i.e. a single port that extends substantially around the perimeter of the cylinder 7. However, other embodiments of the port are possible that allow for different shapes and/or the presence, during at least part of the beverage dispensing phase, of more ports between base wall 5 and cylinder 7. By using a line 5a of irregular shape it is possible to produce, for example, two or more ports.

In general, the maximum extent of the space between piercing member 7 and outlet profile, i.e. the maximum difference between the diameter D2 of the section of engagement of cylinder 7 and the diameter D1 of

the outlet opening defined by the line 5a on base wall 5 of the cartridge is comprised in the range between 0.4 and 1.5 mm. In any case, the total area of port 10 during the dispensing is such as to produce the simultaneous dispensing of water and product for at least 75% of the water-dispensing time. This simultaneous dispensing can be checked visually by observing the colour of the liquid coming out from the cartridge outlet: if the liquid is little coloured or substantially uncoloured there is not simultaneous dispensing in the sense indicated above.

Therefore, an object of the invention is a soluble beverage dispensing group of the type indicated above, wherein the ratio between the area of piercing member 7 and the area defined by the breaking line 5a is comprised in the range between 1.0 and 1.284, preferably with the maximum extent of the space between the opening on the base wall and wall of piercing member 7 comprised in the range between 0.4 mm and 1.1 mm. By area of piercing member 7 is intended the area of the section of piercing member 7 taken at the height of base wall 5 of cartridge 1 when this is housed in the collecting device 2.

In the following description, reference will be made to a preferred embodiment in which member 7 and line 5a are both circular (fig.7). In this embodiment, the port 10 i.e. the dispensing port formed during the dispensing of the beverage (fig.8) by deformation of the base wall of the cartridge along the line 5a, is theoretically substantially circular and crown-shaped in section and the ratio R between the diameter D2 of piercing member 7 and the diameter D1 of the outlet on base wall 5 of the cartridge is comprised in the range between 1.0 and 1.04, preferably between 1.0 and 1.02 and more preferably between 1.0 and 1.014.

As pointed out above, cartridge 1 is made of deformable material, generally produced from plastic material, for example: ethylene or propylene homo- or co-polymer suitable for use with foodstuffs. A



preferred material has cristallinity higher than 70% and a percentage of amorphous polymer as to give visco-elastic deformation to the base wall of the cartridge during the feeding under pressure of hot water. The term "visco-elastic deformation" means that deformation of the material of the base wall, at least in an area around of the edge of the opening on base wall 5 along the line 5a, is reduced or quite eliminated either by the end of the dispensing or in one or more phases during the dispensing. In other words, during all the phase of dispensing of the beverage the material of the base wall, at least in said surround of the outlet opening, opposes the deformation caused by the water or other liquid being fed under pressure into the cartridge. In this way, the extent of the deformation and therefore of the dimensions of the delivery port 10 is controlled during the dispensing of the beverage. The material moulding techniques will be chosen so as to conserve as much as possible the percentage of amorphous polymer in the end product. Suitable materials are chosen from (co)polymers of ethylene and propylene, for example: (co)polymers of propylene comprising one or more alpha-olefins having 2-10 Carbon atoms, for example ethylene, 1-butene, 1-pentene, 4-methyl-1-pentene, 1-hexene, 1-octene; polypropylene formulations obtained by sequential polymerisation of propylene and its mixtures with ethylene and/or alpha-olefins. The (co)polymers generally have Melt Flow Index between 0.2 and 60 at 230°C/21.6 N.

In another embodiment of the invention the extent of the deformation is controlled by using mechanical means. For example: this happens when cartridges are used which undergo plastic deformation of the base wall following feeding under pressure of hot water. In this case the effect described above of opposition to the deformation by the material itself will not occur and "mechanical means" are used in order to limit the extent of the deformation of the base wall. Figures 5 and 6 show a

preferred embodiment of such means, constituted by a ring 12 arranged concentrically with piercing cylinder 7 and spaced from it. Ring 12 is supported on three fins 11 and preferably has a surface portion 13 tilted towards cylinder 7, i.e. towards the inside of device 2, and towards the base wall. The inclination of the upper surface portion 13 is therefore  
5 base wall. The inclination of the upper surface portion 13 is therefore comprised in the range between 0° and 45°, preferably between 15° and 38° and more preferably 30 ° to the horizontal. The said mechanical means can be present in addition to the use of cartridges with at least the base wall in elastically-deformable material.

10 Therefore, an object of the invention is a dispensing group of the type described above wherein there are present means of controlling the deformation of the base wall of the cartridge following the feeding of hot water. Such means are constituted either by a polymer material of construction of the cartridge that has substantially visco-elastic  
15 deformation and/or by mechanical means of support such as a base support ring or fins. In both cases, the extent of the deformation angle of the material around the edge 5a of the delivery opening of the product is maintained within the range between 1° and 45°, preferably between 15° and 38° and more preferably around 30° during the dispensing of the  
20 product solubilized in water.

As an alternative to ring 12, radial fins 11a can be used (fig.9) that extend to the height of surface 13 of ring 12 and that have a portion of their upper surface shaped in similar way to the slanted surface 13 of the ring and similarly distanced from member 7.

25 The invention will now be further described with reference to the following examples given purely by way of illustration.

Example.

Group 1. Ten (10) coffees were dispensed from a Tuttoespresso hot-beverage dispensing machine with a collecting device fitted with a

piercing cylinder of diameter (D2) of 15.0 mm and diameter of the cartridge opening (D1) of 14.7 mm. The cartridge used is made of ethylene co-polymer with substantially visco-elastic deformation of the base wall.

5 Group 2. Another ten (10) coffees were dispensed with cartridge similar, but made of ethylene co-polymer with higher crystalline content and plastic deformation of the cartridge base wall. The collecting device presents a support ring inclined at 30 degrees to the inside and base of the said device.

10 Group 3. For comparison ten (10) coffees were dispensed under the same conditions and from the same machine using traditional cartridges and collecting device.

The assessment was carried out by measuring the volume (cc) of cream obtained. The results show an average of 16.8 cc of cream for each  
15 coffee dispensed in Group 1, an average of 9.6 cc of cream for the coffees dispensed in the Group 2 and an average of 6.8 cc of cream for each coffee dispensed in Group 3 (traditional).

## CLAIMS

1. Dispensing group for the preparation of a beverage from a soluble product, of the type comprising a collecting device having a seat suitable to receive a disposable cartridge containing the soluble product, said cartridge comprising at least one outlet opening for the delivery of a beverage consisting of said soluble product and a fluid, wherein said at least one outlet opening is defined by at least one breaking line present on a wall of said cartridge and wherein said collecting device comprises at least one piercing member to pierce said cartridge in correspondence to said breaking line and to completely engage said outlet opening thereby formed, characterised by comprising means of regulation of the delivery of said beverage in such a way that said soluble product is delivered for at least 75% of the total dispensing time.
2. A group according to Claim 1, wherein said means of regulation comprise at least one delivery port between the wall of said piercing member and the edge of said outlet opening, said port being absent before the beverage delivery phase and present during said phase.
3. A group according to Claim 1 or 2, wherein said at least one engagement portion of said piercing member is substantially cylindrical in shape with circular section and wherein said outlet opening is substantially circular in shape.
4. A group according to Claim 2 or 3, wherein the ratio  $R$  between the diameter  $D2$  of the engagement portion of said piercing member and the diameter  $D1$  of said outlet opening is  $1 \leq R \leq 1.067$ .
5. A group according to Claim 2 or 3, wherein the ratio  $R$  between the diameter  $D2$  of the engagement portion of said piercing member and the diameter  $D1$  of said outlet opening is  $1 \leq R \leq 1.04$ .
6. A group according to Claim 2 or 3, wherein the ratio  $R$  between

the diameter D2 of the engagement portion of said piercing member and the diameter D1 of said outlet opening is  $1 \leq R \leq 1.02$ .

7. A group according to Claim 2 or 3, wherein the ratio R between the diameter D2 of the portion of said engagement piercing member and the diameter D1 of said outlet opening is  $1 \leq R \leq 1.014$ .

8. A group according to Claim 1, wherein said means of regulation comprise one or more stop elements for limiting the deformation of a portion of the wall of said cartridge in proximity of said outlet opening.

9. A group according to Claim 8, wherein said one or more stop elements comprise one or more fins which support said piercing member.

10. A group according to Claim 8 or 9, wherein said one or more stop elements comprise at least one annular member having diameter greater than said outlet opening.

11. A group according to Claim 10, wherein said annular member has a surface portion tilted towards the base wall of said cartridge.

12. A group according to Claim 11, wherein said tilted surface portion has an inclination between  $0^\circ$  and  $45^\circ$  with respect to a horizontal plane supported on said annular member.

13. A group according to Claim 11, wherein said tilted surface portion has an inclination between  $15^\circ$  and  $35^\circ$  with respect to a horizontal plane supported on said annular member.

14. A group according to Claim 11, wherein said tilted surface portion has an inclination of  $30^\circ$  with respect to a horizontal plane supported on said annular member.

15. A group according to one of the preceding Claims, wherein said means of control of the deformation of the base wall are realised with a plastic material having visco-elastic deformation.

16. Method for the preparation of a beverage from a soluble product

contained in a disposable cartridge, wherein said cartridge is lodged in the seat of a collecting device having at least one piercing member in order to open an outlet opening from said cartridge, said opening being defined by at least one breaking line present on a wall of said cartridge and being completely engaged by the said piercing member after having formed said opening, and wherein entry of a fluid into said cartridge is provided for through an entry port of the same in order to obtain the dispensing of a beverage consisting of said soluble product and said fluid, characterised by providing regulation of the dispensing of said beverage so that said soluble product is delivered for at least 75% of the total dispensing time.

17. A method according to Claim 16, wherein the regulation of the dispensing is carried out by means of at least one delivery port between the wall of said piercing member and the edge of said outlet opening during the dispensing phase of the said beverage.

18. A method according to Claim 16 or 17, wherein at least said engagement portion of said piercing member is substantially cylindrical in shape with circular section and wherein said outlet is substantially circular in shape.

19. A method according to Claim 17 or 18, wherein the ratio R between the diameter D2 of the engagement portion of said piercing member and the diameter D1 of said outlet opening is  $1 \leq R \leq 1.067$ .

20. A method according to Claim 17 or 18, wherein the ratio R between the diameter D2 of the engagement portion of said piercing member and the diameter D1 of said outlet opening is  $1 \leq R \leq 1.04$ .

21. A method according to Claim 17 or 18, wherein the ratio R between the diameter D2 of the engagement portion of said piercing member and the diameter D1 of said outlet opening is  $1 \leq R \leq 1.02$ .

22. A method according to Claim 17 or 18, wherein the ratio R

between the diameter D2 of the engagement portion of said piercing member and the diameter D1 of said outlet opening is  $1 \leq R \leq 1.014$ .

23. A method according to Claim 16, wherein regulation of dispensing is carried out by means of one or more stop elements in order to limit the deformation of a portion of wall of said cartridge in proximity of said outlet opening during said phase of beverage dispensing.

24. A method according to Claim 23, wherein said one or more stop elements comprise one or more support fins of said piercing member.

25. A method according to Claim 23 or 24, wherein said one or more stop elements comprise at least one annular member having diameter greater than said outlet opening.

26. A method according to Claim 25, wherein said annular member has a surface portion tilted towards the base wall of said cartridge.

27. A method according to Claim 26, wherein said tilted surface portion has an inclination between  $0^\circ$  and  $45^\circ$  with respect to a horizontal plane supported on said annular member.

28. A method according to Claim 26, wherein said tilted surface portion has an inclination between  $15^\circ$  and  $35^\circ$  with respect to a horizontal plane supported on said annular member.

29. A method according to Claim 26, wherein said tilted surface portion has an inclination of  $30^\circ$  with respect to a horizontal plane supported on said annular member.

30. A method according to one of Claims 16 to 29, characterised by controlling said deformation by means of the use of plastic material with visco-elastic deformation in at least part of the base wall of said cartridge.

31. Disposable cartridge for the preparation of a beverage from a soluble product in a group for beverage preparation according to any of Claims 1 to 15 or by performing a method according to any of Claims

16 to 30.



Fig. 1

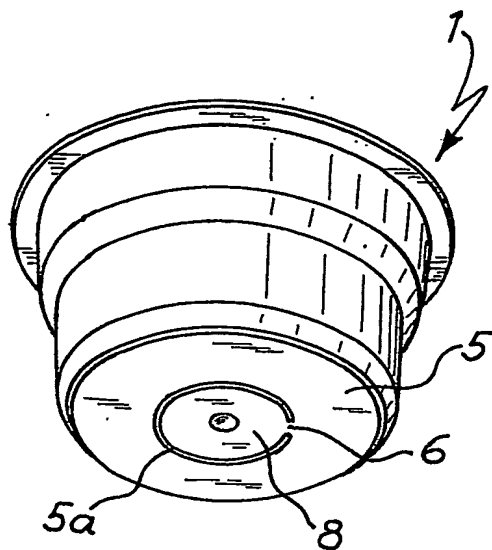


Fig. 2

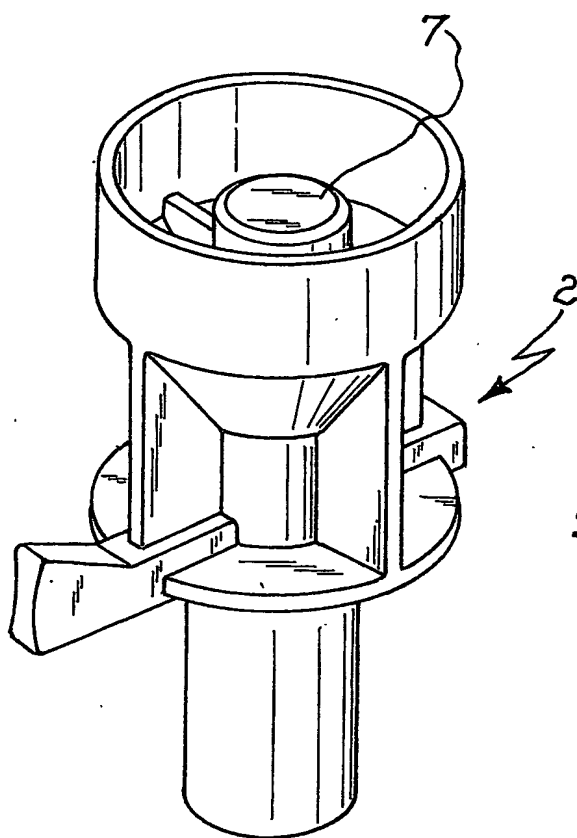
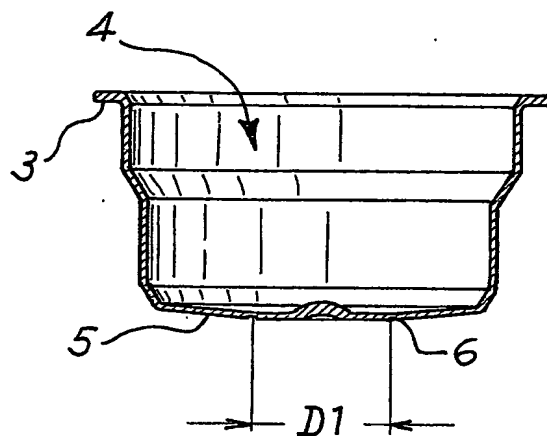


Fig. 3

Fig. 4

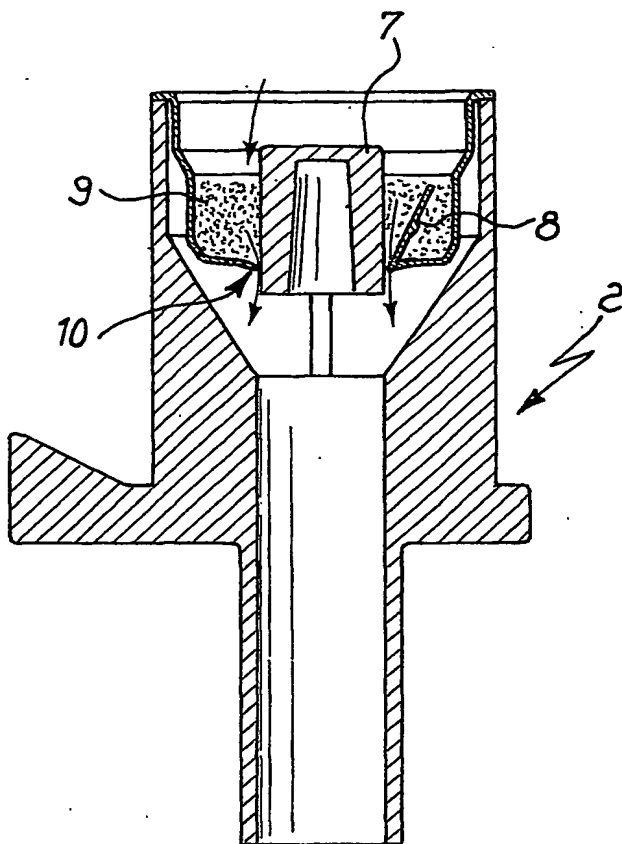


Fig. 5

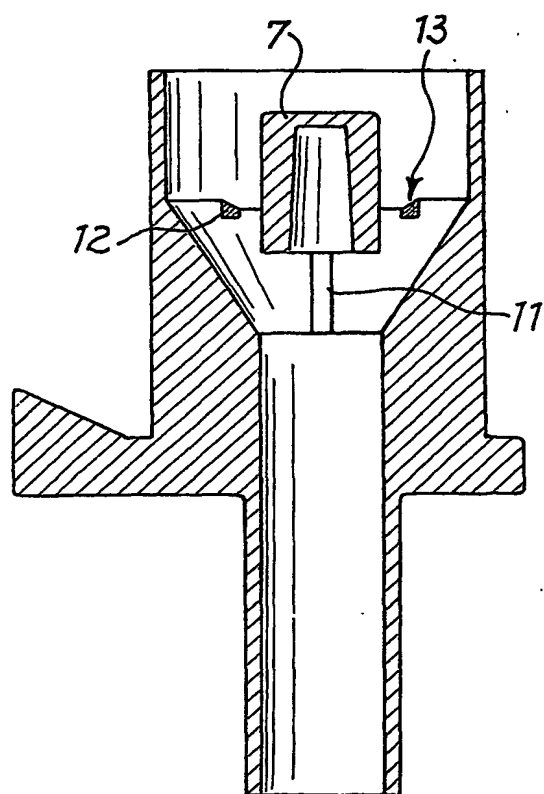


Fig. 6

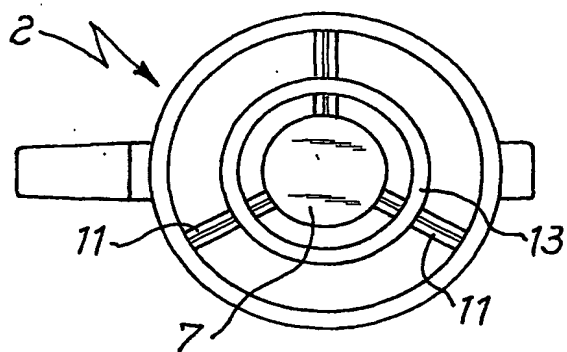


Fig. 7

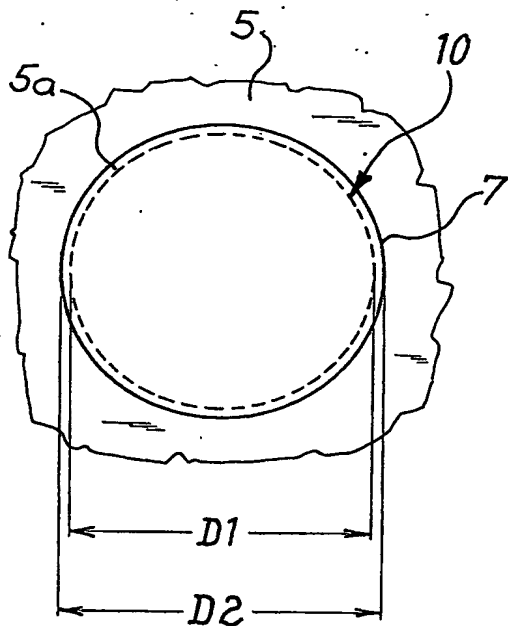


Fig. 8

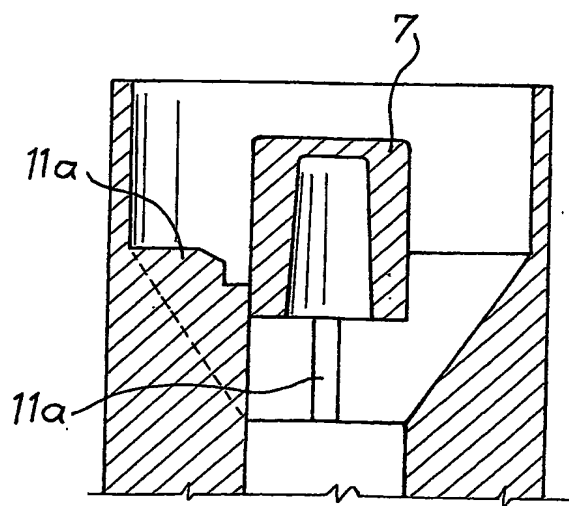
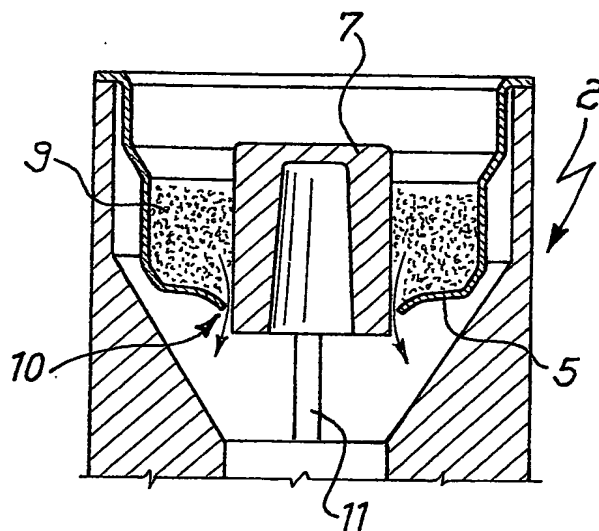


Fig. 9

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/IT 02/00632

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 7 A47J31/40 A47J31/06

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 A47J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

EPO-Internal

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
E	WO 02 076270 A (MAJER DOGLIONI LUCA ;TUTTOESPRESSO S P A (IT)) 3 October 2002 (2002-10-03)  page 5, line 16 -page 10, line 10; figures 1-3,6-8	1-3, 8-10, 15-18, 23-25, 30,31
A	US 5 347 916 A (FOND OLIVIER ET AL) 20 September 1994 (1994-09-20)  column 3, line 1-43	1,8,16, 18,23, 26,31
A	CH 688 686 A (COFFEA SA) 15 January 1998 (1998-01-15)	
A	US 5 008 013 A (FAVRE ERIC ET AL) 16 April 1991 (1991-04-16)	

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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# INTERNATIONAL SEARCH REPORT

International Application No  
PCT/IT 02/00632

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